

The Rise of Physiology in England.

THE HARVEIAN ORATION, 1895.

BY

WILLIAM SELBY CHURCH.

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with the author's kind regards

THE RISE OF PHYSIOLOGY IN ENGLAND.

THE HARVEIAN ORATION

DELIVERED BEFORE

THE ROYAL COLLEGE OF PHYSICIANS,

October 18th, 1895.

BY

WILLIAM SELBY CHURCH, M.D.Oxon.,

FELLOW OF THE COLLEGE; SENIOR PHYSICIAN TO ST. BARTHOLOMEW'S
HOSPITAL; REPRESENTATIVE OF THE UNIVERSITY OF OXFORD IN THE
GENERAL COUNCIL OF MEDICAL EDUCATION AND REGISTRATION.

LONDON:

PRINTED BY ADLARD AND SON,
BARTHOLOMEW CLOSE, E.C., AND 20, HANOVER SQUARE, W.

1896.

Thos. Dr.



DE. 41. AA6-8

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TO

SIR J. RUSSELL REYNOLDS, BART., M.D., F.R.S.,

PRESIDENT OF THE ROYAL COLLEGE OF PHYSICIANS,
PHYSICIAN IN ORDINARY TO HER MAJESTY'S HOUSEHOLD,

THIS ORATION,

DELIVERED IN OBEDIENCE TO HIS DESIRE,

IS DEDICATED

WITH SINCERE RESPECT.

THE HARVEIAN ORATION.

MR. PRESIDENT,—In obeying your request that I should undertake the delivery of the Harveian Oration, I am painfully sensible of the gravity of the task you have imposed on me. For 239 years, with but few intermissions, the College has, in obedience to Harvey's own wishes, assembled to commemorate its benefactors ; and if we can no longer precisely follow Harvey's directions, and "commemorate all the benefactors of the said College by name, and what in particular they have done for the benefit of the College," the remainder of his words are still applicable, for part of the Harveian Orator's duty is "to exhort others to imitate those benefactors, and to contribute their endeavours for the advancement of the Society according to the example of those benefactors." This annual office has been filled

during the years that have elapsed since Harvey's institution of it by some of the most illustrious Fellows on our roll—by Garth (1697), Arbuthnot (1727), and Akenside (1759); by Mead (1723), Heberden (1750), and Warren (1768), not to mention others of more recent date, men whose names will ever remain fresh in the history of the literature and medicine of our country. I have no claim to be associated with these great names, nor with the many learned and eloquent men who have addressed you in recent years, and I should have shrunk from attempting the task your favour has imposed on me had I not felt that in asking me to undertake it you were mindful of the position which it is my lot to hold in connection with the great hospital to which the immortal Harvey was thirty-four years physician, in which he exercised an influence over its governing body that remains to this day, and where his memory is yet held in reverential remembrance.

I wish it were possible for me to bring forward from the records of St. Bartholomew's Hospital any new facts illustrating either Harvey's life or works; but many years ago

Sir James Paget, in his *Records of Harvey*, (a) exhausted all that is known of him from the journals of our hospital. In the fragmentary notices which we there meet with he is seen as the trusted adviser to the governing body, and as the maintainer of the dignity of his order rather than as the physician. In his *Prelectiones Anatomicæ Universalis* we obtain glimpses of his work in the wards of the hospital, and had his *Medical Observations* come down to us, there can be little doubt that in them much would have been found which emanated from the wards of the hospital, and the dissections of patients who died whilst under treatment there.

Foremost among the benefactors to our College present to the mind of Harvey when he established this annual Oration must have been Dr. Richard Caldwell (b) and Lord Lumley, who together founded and endowed in 1581 the Surgery Lecture, which, under the name of the Lumleian Lecture, Harvey held from 1615 until 1656, and in the course of which he demonstrated to the College his immortal discovery.

I have failed to find out the nature of the connection, if any, between Caldwell and Lord

Lumley. The latter succeeded his father-in-law, Lord Arundel, as High Steward of the University of Oxford in the year 1558, the year before Caldwell appears to have completely severed his connection with the university. Of Lord Lumley Camden says "that he was a person of entire virtue, integrity, and innocence, and in his old age a complete pattern of true nobility."

By the kindness of our Registrar, my attention has been drawn to the very interesting notice of Caldwell in Holinshed's *Chronicles*, where an account is given of the first lecture delivered under the terms of this bequest by Dr. Richard Forster, "which was celebrated by a goodlie assemblie of Doctors, Collegiate and Licentiate, as also some Masters of Surgerie, with other students, some whereof had been Academical. Dr. Caldwell, his white head adding double reverence to his person, notwithstanding his age and impotencie, made an Oration in Latin to the auditorie, the same by occasion of his manifest debilities unfinished at the direction specialle of the President; who, after a few words shortlie and sweetlie utered, gave occasion and opportunity to Dr.

Forster, (c) then and yet the appointed Lecturer, to deliver his matter.”

It is impossible for me to mention the long list of those who by their munificence, or by the honour which their lives and labours have bestowed on the College, have to be commemorated as benefactors since the days of Harvey.

Within the present year we have had a notable example, not only of the generosity, but, what is still more to be desired, of the brotherly feeling which Harvey desired should exist among us. No one among our Fellows has, during the last fifty years, been a brighter ornament to this College or a greater benefactor to his country or the world at large than Edmund Alexander Parkes. It must be a source of gratification to us all that Dr. Hermann Weber, when generously endowing the College with the magnificent sum of £3000 for the furtherance of original research on the “Prevention and Cure of Tuberculosis,” should have associated Dr. Parkes’s honoured name with his own. The triennial prize, which the College has decided to found with this bequest, will tend, let us hope, not only to keep fresh in the memories of many generations of Fellows

the genial and liberal donor and his valued friend, but may accomplish the object of the giver and lead to future discoveries by which the ravages of tuberculous disease may be controlled and abated, if not altogether prevented.

It may interest the College to know that the subject selected for the first competition is "The Means, Prophylactic or Curative, deemed by the Author to have Value in the Control of Tuberculosis, especial regard being had to their Application to Human Tuberculosis."

I should like to pause here to set before you at somewhat greater length the useful, pure, and unselfish life of Dr. Parkes, and to recall to your memory the excellence of his scientific work in connection with the ingestion and elimination of nitrogen in the system, as well as to draw your attention to the benefits which our naval and military services and the general public have received from his labours in the field of hygiene; but I must pass on now, and content myself with thus briefly alluding to the munificent gift of Dr. Hermann Weber and the memory of Edmund Alexander Parkes.¹

¹ Dr. Parkes died of acute general tuberculosis, March 15th, 1876.

Harvey's fame is immortal, and he is to be placed in the same category with Hippocrates, Aristotle, Archimedes, and Newton, who by their genius may be looked upon not so much as the exponents as the founders of their respective branches of knowledge. Aristotle was the first, and in a sense the greatest, of biologists. Harvey was the founder of physiology. Harvey himself was an Aristotelian, educated in all the learning of the schoolmen; and in attempting to estimate his genius and originality it is almost impossible for us in these days of independent thought to realise the crushing influence which authority then exercised on the minds of men; in the words of Dryden, they—

Betrayed

Their freeborn reason to the Stagyrte,
And made his torch their universal light.¹

As in medicine, although there must have been practitioners before the days of Hippocrates, he is to be taken as the starting-point, so in biology, notwithstanding the labours of Parmenides, Empedocles, and others of still earlier date whose writings are known to us

¹ *Epistle the Third. To Dr. Carleton.*

but by fragments, Aristotle stands alone as the originator of biological science. He, together with his immediate successors, took, as has been observed by Professor Huxley,¹ “the broadest view of the subject, and man assumed his place as neither more nor less scientifically interesting than his fellows.” (*d*)

Harvey's admiration of Aristotle is profound; he calls him the supreme dictator in philosophy, and in the introduction to the *De Generatione Animalium* says, “Foremost among the ancients I follow Aristotle; he is my leader.” (*e*) Dr. W. Ogle, in the preface to his excellent translation of Aristotle's work *On the Parts of Animals*, says most justly, “The biological treatises of Aristotle are more often quoted than read; and it may be added much more often misquoted than correctly quoted.” The prominent feature of Aristotle's biological writings, as indeed of his philosophy generally, is classification, in which respect his writings contrast strongly with the poetical and imaginative treatises of his forerunner Plato. From the time of Aristotle to that of Harvey no advance was made in physiolo-

¹ Appendix to Richard Owen's *Life*.

gical knowledge; in truth, it had receded, overwhelmed by the glosses and erroneous interpretations so often put on Aristotle's writings.

In attempting to estimate Harvey's merits as a discoverer it is necessary for us as far as possible to realise the state of knowledge at the commencement of the seventeenth century, and the nature of his surroundings. Subsequently to the time of Aristotle, who was very imperfectly acquainted, as he himself admits, with human anatomy, the Alexandrian school, where the two rivals, Erasistratus and Herophilus, practised human dissection, had considerably advanced human anatomy; their observations and discoveries were made use of by Galen, who added to anatomical knowledge by his accurate dissections of the lower animals, including apes. The anatomical facts thus observed were of comparatively little use through their being treated as disjointed observations: thus there can be no doubt that Erasistratus observed the lacteals in the mesentery of sucking kids hundreds of years before Aselli rediscovered them in dogs; and Aselli's observations would have proved as

barren as Erasistratus's had Pecquet not traced the lacteals to the receptaculum chyli and thoracic duct, which vessel had many years before been noticed by Eustachius in the thorax of the horse, and described by him as the *vena alba thoracis*.

With the revival of learning human anatomy began to be studied on account of its obvious bearing on medicine and surgery, and by Harvey's time, owing to the labours of Mundinus, Sylvius, Eustachius, Vesalius, Fallopius, and others, the details of the bodily structure of man observable by the unassisted eye were for the most part discovered.

In physiology, on the other hand, there had been no advance whatever, unless the very imperfect knowledge of the lesser circulation be considered as having a claim to be so regarded. It in no way detracts from Harvey's merit or originality that Servetus, Columbus, and Cesalpinus all had an idea of the lesser circulation,—without, however, comprehending it or seeing to what it led, nor that Fabricius had demonstrated beyond doubt the existence of the valves in the veins. Dugald Stewart has remarked, “In the sciences, the observations

and conjectures of obscure individuals on the subjects which are level to their capacities, and which fall under their own immediate notice, accumulate for a course of years, till at last some philosopher arises who combines these scattered materials, and exhibits in his system not merely the force of a single man, but the intellectual power of the age in which he lives.”¹

Regard must also be paid to the spirit of the times, and the remarkable uprising of independent thought and inquiry which characterises the century immediately preceding Harvey’s birth.

Bacon is frequently spoken of as the founder of inductive philosophy and the destroyer of the syllogistic reasoning which had been all-powerful before his day. This may be true when applied to moral, but is certainly not so when we consider physical or natural philosophy. In his biological writings Aristotle makes constant use of the inductive process, and he points out that it is absurd to suppose that syllogistic reasoning could lead to the dis-

¹ *Elements of the Philosophy of the Human Mind*, vol. i, p. 217, sixth edition.

covery of any new principles;¹ and again he says, still more definitely, "That reasoning is naturally prior and more known than proceeds by syllogism, yet is that more perspicuous to us which is based on induction."²

Aristotle's inveterate custom of specifying a final cause for every structure and organ which he came across in the animal body not only led him to many absurdly erroneous conclusions, but joined with the oft-quoted maxim of Bacon, "*Causarum finalium inquisitio sterilis est et tanquam virgo Deo consecrata nihil parit*," has led to the wonderful work he did in biology being less thoroughly appreciated by us than it deserves. Bacon's objection to the consideration of final causes in physics was owing to his belief that it "banished the study of physical causes; the fancy amusing itself with illusory explanations derived from the former." That Bacon was wrong in this view is proved by Harvey himself, for we have it in his own words, as reported by Boyle,³ that it was from studying the valves of the veins, and believing

¹ *Physics*, lib. i, c. 2, sect. 3.

² *Analytics*, Post. 2.

³ Boyle's *Works*, folio edition, vol. iv, p. 539.

“that so provident a cause as nature had not placed so many valves without design,” that he was first induced to think of a circulation of the blood. (*f*)

Equally false is the belief, very generally held, that Bacon was the first to revolt from the tyranny of the Aristotelian school. The alliance which had taken place between the Papal Church and the Aristotelians caused those who at the Reformation refused to recognise the infallibility of the Church of Rome also to throw off their allegiance to the tenets of the schools. Luther and Calvin, not to mention lesser men, declared that no man could be an Aristotelian and a Christian; and St. Paul’s warning, “Beware lest any man spoil you through philosophy and vain deceit, after the tradition of men,”¹ was a favourite text for the ministers of the Reformation to expound.

The same spirit of inquiry which broke down the tyranny of the Church also freed men’s minds from the trammels of the dogmas of the current philosophy. The physicists, by questioning the accepted doctrines of the nature of the universe, were the first to commence this

¹ Col. ii, 8.

healthy movement, and the wide-spread popularity of Ramus's teaching very greatly expedited the change which occurred. Ramus, from the commencement of his career, disputed the authority of Aristotle, and may be said to have spent his whole life in opposing the orthodox philosophy of the times, and perished a martyr to his opinions and the rancour of his opponents in the massacre of St. Bartholomew's Day (1572). (*g*)

Harvey, when at Padua, must have been in the midst of the conflicting theories and bitter controversies of the Aristotelians and their opponents. His even and well-balanced mind prevented his joining either party. Throughout all his writings he pays the greatest respect to Aristotle, and takes him as his main guide in his work *De Generatione Animalium*. He makes also constant references to him in his *Prelectiones Anatomicae Universalis*; and when Aubrey asked him what he should read, bid him go to the fountain head and read Aristotle, Cicero, and Avicenna. The same authority tells us that Harvey, whilst esteeming Bacon much for his wit and style, was not enamoured of his philosophy. It would be interesting to know how

intimate Harvey was with the Lord Chancellor, and whether their communications merely partook of the character of physician and patient, or whether Harvey discussed philosophical questions with the older man.

My predecessors in this office have so fully vindicated Harvey's claim to the discovery of the circulation against the attempts which have been made within recent years to deprive our countryman of this honour, that I will pass on, merely thanking Sir Edward Sieveking and Sir George Johnson for the able and triumphant manner in which they have refuted the statements put forward in favour of Cesalpinus as the true discoverer of the circulation of the blood.

Neither Servetus, Columbus, nor Cesalpinus in any way anticipated Harvey, who not only discovered the greater circulation, but demonstrated it and explained the true motion of the heart. He, and he alone, recognised the muscularity (*h*) of the heart's wall, and perceived and demonstrated that it was the contractile power of the heart which was the primary cause of the pulse and of the circulation of the blood through both systemic and pulmonary vessels.

Harvey, by a chain of close and acute reasoning, drawn from direct experiments, and from observations on the pulsation in aneurysms and in vessels distal to aneurysmal dilatations and to portions of rigid and calcified arteries, demonstrated once for all that the motion and contraction of the heart was the main, though not the only cause of the pulse. (i)

Leaving, then, the *Exercitatio Anatomica de Motu Cordis et Sanguinis*, I wish to consider that which Harvey's discovery rendered possible, the rise of physiology, more especially in England, and the part which Harvey himself took in founding it.

It must be always borne in mind that but a portion of Harvey's work has come down to us. We gather from his extant writings that he had collected materials for, if not composed and completed, the following treatises :—*Observationes de Usu Lienis*; *Observationes de Motu Locali*; *Tractatus Physiologicus de Amore Libidine et Coitu Animalium*. We do not know how far advanced his *Medical Observations*, to which he makes frequent references; his disquisitions on the *Cause, Uses, and Organs of Respiration*; his *Medical Anatomy*, or *Anatomy*

in its Application to Medicine may have been Harvey announces, in his first disquisition to Riolanus, his “intention of putting to press this last work ;” and it must be regarded as an irreparable loss that the world should have been deprived of the material he had collected, for one cannot doubt that his *Medical Anatomy* would have displayed the same master mind as is shown in his other works, and that morbid anatomy would have been advanced to the position it was placed a hundred years later by Morgagni. As it is, we have to collect Harvey’s general views of physiology from scattered passages in his works.

Next to his *Exercitatio Anatomica de Motu Cordis et Sanguinis*, his most important treatise is *De Generatione Animalium*. This is an unfinished work. Harvey had probably intended to publish a larger and more complete work, but had failed to satisfy himself on the subject of generation, and what he was persuaded by Sir G. Ent to entrust to him for publication were but the exercises from which Harvey had intended to compile his treatise. Possibly the loss of his *Observations on the Generation of Insects* prevented his undertaking the larger work ; for

no one who reads the treatise will come to the opinion that Harvey was prepared to publish it in the shape in which we now have it. In the exercises we find much repetition both of words and ideas, much speculative matter on which he expresses no opinion. Not having satisfied himself as to the facts of generation, he allows himself to be under the influence of the

“Master Sage of those who know”

(Dante's *Inferno*, cant. iv, l. 131),

and wanders off from observed facts into the shadowy but enticing realms of fancy and metaphysics.

It is no detraction from Harvey's merit that he failed in understanding the nature of generation. The necessary means were not in existence; the simple magnifying glasses he used for the inspection of the *punctum saliens* were unable to show him his error in supposing that the male element did not enter the uterus—a conclusion he came to after repeated inspections. Writing of the uterus of the doe after copulation, he says, “I began to doubt, to ask myself whether the semen of the male could by any possibility make its way by attraction or injection to the seat of conception; and

repeated examination led me to the conclusion that none of the semen reached this seat ;” (*l*) and in another place he asks “ whether the conception of the uterus be of the same nature or not with the conceptions of the brain, and fecundity be acquired in the same way as knowledge—a conclusion in favour of which there is no lack of argument ;” (*l*) and in his essay on Conception he gives us what I imagine was his final conclusion : “ The woman, after contact with the spermatic fluid *in coitu*, seems to receive an influence and become fecundated without the co-operation of any sensible corporeal agent, in the same way as iron touched by the magnet is endowed with its powers.”

The aphorism *Omne vivum ex ovo* (*m*) is ascribed to Harvey, and often quoted as if he made use of the expression. It is true that at the end of his consideration of the development of the egg he concludes by quoting Aristotle with approval : “ All living creatures, whether they swim, walk, or fly, and whether they come into the world in the form of an animal or of an egg, are engendered in the same manner.” But it is quite evident from many passages in his treatise that Harvey did not unconditionally

reject the doctrine of spontaneous generation. In Exercise lxiii, after stating, "Now we at the very outset of our observations asserted that all animals were in some sort produced from eggs," he goes on to explain his meaning more fully: "An egg is a conception exposed beyond the body of the parent, whence the embryo is produced. Let us therefore say that that which is called *primordium* among things arising spontaneously, and seed among plants, is an egg among oviparous animals; the prime conception in viviparous animals is of the same precise nature." And earlier, in Exercise xlv, when discussing the difference between epigenesis and metamorphosis, he says, "Some animals are born of their own accord, concocted out of matter spontaneously." Harvey showed that the mode of development and growth was the same in the embryos of viviparous and oviparous animals, and maintained that in creatures said to arise spontaneously or to take their origin from putrefaction, filth, &c., the same developmental changes occurred, but nowhere expresses an opinion as to the origin of the ova themselves, although it is probable that he inclined to the belief that they were

“propagated from elements and seeds so small as to be inconspicuous (like atoms flying in the air), scattered or dispersed here and there by the winds.” (*n*) In the same way he expresses no opinion as to the origin of the animalcules engendered in our bodies, and of the worms produced from plants and their fruit or from gall-nuts, the dog-rose, and various other galls, contenting himself with remarking that the living principle of the animals thus arising cannot have existed in the plants on whose juices they live.¹

Though misled from the want of proper means for observation in the fundamental facts of generation, there is much touching general physiology scattered through the treatise which is extremely interesting. Harvey remarks that he was the first to note that the bronchia or ends of the trachea in birds open into air-sacs in the abdominal cavity, (*o*) an observation which, so far as I know, attracted no attention, and did not receive confirmation until John Hunter demonstrated these air-sacs afresh, and showed that the bronchia in birds were continuous also with the hollow spaces in their

¹ Exercise xxvii.

bones. In Exercise lvi he has anticipated Darwin's explanation of sexual adornments, remarking, "Ornaments of all kinds, such as tufts, crests, combs, wattles, brilliant plumage, and the like, of which some vain creatures seem not a little proud, are most conspicuous in the male at that epoch when the females come into season; and whilst in the young they are still absent, in the aged they also fail as being no longer wanted." Hereditary likeness did not escape him, nor that form which is spoken of as atavism, for he asks "why the offspring should at one time bear a stronger resemblance to the father, at another to the mother, and at a third to progenitors, both maternal and paternal, further removed." (*p*)

After the circulation of the blood and the mysteries of generation, the subject which appears to have had most attraction for Harvey was that of "innate heat"—*calidum innatum*—the *θέρμη ἐμφυτος* of Aretæus, a term by which more was meant than the temperature, although that was the sensible evidence of it. Harvey distinguished the *anima*—soul or vital principle—from the innate heat; to the consideration of the latter he devotes Exercise lxxi, and

treats at length of the former in Exercises xxvi and xxvii. It would take me too long to attempt to give a sketch of his views of the *anima*; it is clear that he himself was dissatisfied with his own conception of the vital principle or *anima*, for he says in Exercise xxviii, speaking of the way in which the egg is produced, "Leaving points which are doubtful, and disquisitions bearing upon the general question (that is, on the *anima*), we now approach more definite and obvious matters."

Animal heat before the knowledge of the production of heat by chemical union was an inscrutable mystery, which not even the genius of Harvey could penetrate. The maintenance of animal heat was supposed to be the gift of the heart to the blood. The belief that the heart was the source of heat was universally held by the ancients, Aristotle saying "that its wall is thick that it may serve to protect the source of heat."¹

This Aristotelian doctrine Harvey dissented from and destroyed by reasoning little less cogent than that by which he demonstrated the circulation, although he was unable to

¹ *De Part Animalium*, book iii, chap. 4.

account for the presence of animal heat, and imagined that it was inherent in the nature of blood, and of divine origin. His words are so grand and poetic that I may be permitted to quote them at length.

“I say that innate heat and the blood are not fire, neither do they derive their origin from fire. They rather share the nature of some other, and that a more divine body and substance. They act by no faculty or property of the elements; but as there is something inherent in the semen which makes it prolific, and as in producing an animal it surpasses the powers of the elements—as it is a spirit, namely, and the inherent nature of that spirit corresponds to the essence of the stars—so there is a spirit of certain force inherent in the blood acting superiorly to the powers of the elements, very conspicuously displayed in the nutrition and preservation of the several parts of the animal body; and the nature, yea, the soul in the spirit and blood, is identical with the essence of the stars.” (*q*) This outburst of Harvey’s is most striking, so unlike his usual manner, and one cannot but be astonished at his inconsistency, for it occurs

in the same exercise as the following shrewd and calm remark :—" We are too much in the habit, neglecting things, of worshipping names. The word blood, signifying a substance which we have before our eyes and can touch, has nothing of grandiloquence about it; but before such titles as spirit and *calidum innatum*, or innate heat, we stand agape:" for assuredly the substitution of the phrase that the nature inherent in the blood was responsive to the essence of the stars is not less calculated to set us wondering than is the term "*calidum innatum*." Harvey nevertheless disproved for once and all the doctrine that the heart was the source of heat; he showed how animal heat was dependent on the due circulation of the blood, and that the belief that the function of the lungs was to cool the heated blood was absurd. He says, "The blood, instead of receiving, rather gives heat to the heart, as it does to all parts of the body; and it is on this account that the heart is furnished with coronary arteries and veins: it is for the same reason that other parts have vessels, namely, to secure the access of warmth for their due conservation and stimulation, so that the

warmer any part is the greater its supply of blood; or otherwise, where the blood is in the largest quantity, there also is the heat the highest."

The *Prelectiones* are but notes to assist Harvey whilst lecturing, and it is therefore impossible to know what interpretation to place on them, but I think it highly probable that in the course of years Harvey, as his physiological knowledge increased, modified his views of the connection between animal heat and the heart, for in the *Prelectiones* he speaks of the heart as the *fons totius caloris*, and calls it *arx et domicilium caloris*, from which it appears that in 1616 he still held the Aristotelian opinion of the heart being the source of heat.

No portion of the *Prelectiones* show more strikingly the closeness of Harvey's observation, the amount of his knowledge, and the acumen of his reasoning than that relating to the exposition of the anatomy and the functions of the lungs. In his description of them and the pleuræ he makes constant references to their morbid anatomy and their embryonic condition. He is evidently in doubt whether the lungs expand and contract from their

own movements, or merely follow the movements of the thorax (*r*)—a question which was afterwards fully investigated and explained by Mayow.

The immediate followers of Harvey naturally turned their attention to the subjects on which he had thrown so much light—the circulation and respiration. Most notable among them were two distinguished Cornishmen, Richard Lower and John Mayow. (*s*) The former is the best known from his experiments on the transfusion of blood, which attracted the attention of the general public; but those experiments, though the best known, are by no means the most important of his physiological researches. In addition to demonstrating in many ways that the red colour of arterial blood was due to the action of the air, he calculated also the force of the heart and the quantity of the blood passing through it. He showed also by demonstrations on dogs that œdema of the parts distal to the heart followed ligature of the veins, and produced ascites by tying the vena cava in the thorax. Lower also was the first to show the dependence of the heart's action on nervous influence, and to

demonstrate the moderating effect of the pneumogastric nerve on the heart.

Mayow, though recognising that there was an interchange between the blood and air in the lungs, still thought that the source of vital heat was in the heart; “not that it contained a biolynchium (that is, a vital torch) flaring within it, but that, from its perpetual motion for carrying on the circulation, the nitro-aërial and sulphureous particles in it must be in a state of perpetual effervescence, and that necessarily remarkable heat must be excited.”¹ Mayow thought that air was impregnated with a certain universal salt, which was of the nature of nitre, and with vital spirit, and with fire. Notwithstanding this erroneous view of the nature of air, it is remarkable how closely his explanation of the action of this imaginary salt on the blood agrees with the actual action of oxygen, and he sums up his conclusions as to the uses of respiration as follows:—“Life consists in the distribution of animal spirits which must be supplied for the pulsation of the heart. In very truth it is highly probable that the aërial salt is necessary for any muscular

¹ *De Spiritibus Animalibus*, chap. iv, p. 31.

movement, so that without it no pulsation of the heart is possible.”¹ In his essay *De Respiratione Fœtus in Utero et Oro* he correctly infers that the blood of the fœtus obtained through the umbilical arteries not only nourishment, but also aërial salts, which obviated the necessity of functional activity in the lungs during intra-uterine life, and states definitely that the placenta should not be regarded as an amplified liver, but as a uterine lung. (*t*) It is not for his chemico-vital theories alone that Mayow deserves to be remembered; he first accurately described the action of the intercostal muscles and diaphragm, and showed that inflation of the lungs depended on atmospheric pressure.

It was not until upwards of a hundred years later, when Black had shown the presence of carbonic acid in expired air, and investigated the phenomena of latent and sensible heat, when Priestley had isolated oxygen, and Cavendish and Lavoisier had completed the analysis of atmospheric air, that any real progress could be made in the study of respiration and animal or vital heat. (*u*) Even now we are by

¹ *De Respiratione.*

no means fully acquainted with this most complex and difficult subject. Your Croonian Lecturer pointed out a few months ago some of the many difficulties which still have to be surmounted before we can arrive at an adequate knowledge of how and where the interchange between the oxygen of the air and the tissues takes place, and how our systems accommodate themselves to the changes of pressure and temperature in the air, so as to maintain the animal heat at a uniform level.

I have endeavoured, very imperfectly I fear, to set before you the rise of physiology in England. Before the discovery of the circulation of the blood a right understanding of the means by which life is carried on was impossible, and Harvey's discovery should rank on the same level as Newton's discovery of gravitation. In both cases others had to a certain extent prepared the way, and may have had glimpses of the truth, but to them the truth was revealed, and they might say with 'Tennyson's Ancient Sage—

“Idle gleams to thee are light to me;”

and the light which their genius led them to perceive enabled their successors to reveal

what we now know of the mysteries of animate and inanimate nature.

We know very little of Harvey's practice as a physician ; what little we can gather from his writings show him to have been fertile in resource and skilful in the management of gynaecological cases. We cannot doubt that one who showed such acumen in deciphering the problems of life, and who speaks so wisely of the necessity for the study of morbid anatomy, must have been far ahead of the rest of his contemporaries in the application of his knowledge to clinical work ; and the disparaging gossip of Aubrey merely reflects the opinions of those too ignorant and too bigoted to appreciate him. (*v*)

I have already spoken of the overpowering authority of Aristotle over the minds of the students of Nature, but the completeness of his dominion was not to be compared to the overwhelming influence of Galen in the medical world during the sixteenth and early part of the seventeenth centuries, and it needed yet another than Harvey to enable men to throw off the benumbing mantle of Galen. Our College annals recount, as pointed out by our learned Librarian in his Roll of the College, that in the

year 1559 Dr. Geynes was refused the Fellowship because he had ventured to doubt the infallibility of Galen; and in our annals it is stated that Dr. Hook was not granted admittance to the examination for the licence because he had the honesty to say that he had not read Galen. The revival of anatomy had by Harvey's time somewhat undermined the authority of Galen, which was still further impaired by Harvey's own discoveries. Nine years after Harvey's death appeared Sydenham's *Methodus curandi Febres Propriis Observationibus Superstructa, &c.*, and the world became aware that one had arisen who brought independent thought, unbiassed by the traditions and views of the various schools of medicine, to bear on the study of disease.

Our ignorance of the details of Sydenham's life renders it difficult to express an opinion as to the position he occupied in society or among his professional brethren in the year 1666, when the *Methodus* first appeared. He had then been settled in Westminster for ten years, (*w*) and his intimacy during his Oxford life with Locke and Boyle (to whom he dedicates the work) makes it probable that from his first

arrival in town he must have mixed with those bright and inquiring minds who instituted the Royal Society. Be that as it may, his treatise at once attracted their attention, and in the same year in which it was published we find it reviewed in the *Philosophical Transactions of the Royal Society*, then in the second year of its existence.

I will not stay to consider how great or how small were Sydenham's literary acquirements, or whether he wrote his works in Latin, or whether they were translated from the vernacular by Dr. Mapletoft and Mr. Havers; the subject is fully treated of by Dr. Latham in his *Life of Sydenham*, and I know of no fresh evidence that has been obtained. Whatever may have been the amount of Sydenham's scholarship, no one who reads his works can fail to see from his frequent allusions to Horace, Lucretius, Seneca, &c., that he was intimately acquainted with the Latin classics; and, like Dr. Latham, I should be sorry to consider that his admiration for Hippocrates—the divine old man—was taken at second-hand. As to the other disputed point, whether Sydenham served as an officer in the Parliamentary army, the

question has been set at rest by the discovery in the Record Office of a petition to the Lord Protector signed by Thomas Sydenham, and endorsed Captain Sydenham's Petition.¹

Nurtured during the civil war, the rough and turbulent early life of Sydenham left perhaps its stamp upon his character—a thoroughly upright, honest, God-fearing man, but somewhat intolerant of opposition, and of singular independence of mind. He had not the sweet nature of Harvey, which appears to have enabled that gifted man to have lived in peace with all men; but we must, I think, receive with caution the few contemporary anecdotes which have come down to us concerning him. It is pretty certain that Sydenham thought Sir R. Blackmore a pedant and prig—an opinion shared by many; for, besides Dryden's well-known castigation of Sir Richard Blackmore, we have the following description of him by a contemporary :

“ By nature formed, by want a pedant made,
Blackmore at first set up the whipping trade ;

¹ A copy of the petition, together with other notes concerning Sydenham, was published by Dr. Gee in *St. Bartholomew's Hospital Reports*, vol. xix, p. 1.

Next quack commenced, when fierce with pride he swore
 That toothache, gout, and corns should be no more.
 In vain his drugs as well as birch he plied,
 His boys grew blockheads and his patients died."

COL. CODDRINGTON.

The oft-quoted story of the advice Sydenham gave him to read *Don Quixote* was probably only passing on that which Locke had given Sydenham, for the former says, "Of all the books of fiction, I know none that equals Cervantes' *History of Don Quixote* in usefulness, pleasantness, and constant decorum."¹ And it may also have contained a covert allusion to the fictitious character of most medical writings.

Sydenham's independence of mind is the key to his position in medicine. The opening paragraph in the preface to the first edition of the *Methodus Medendi* exhibits to us the serious and lofty view that Sydenham took of the physician's duty, whilst in the greatly expanded preface to the third edition he instructs us as to the means by which the science of medicine was to be advanced. It was his determination to study diseases as they pre-

¹ *Some Thoughts concerning Reading and Study.*

sented themselves to him, keeping the peculiar and constant phenomena apart from the accidental and adventitious, and laying aside all hypotheses as to their nature, which enabled Sydenham to draw up those pictures of gout, dropsy, and fever which will remain classical for all time, and justly entitle him to be called the modern Hippocrates. From Harvey's physiological teaching, and from clinical observations carried on in the spirit of Sydenham, our present knowledge of disease became possible. Harvey's work and writings had no direct influence on Sydenham; the latter makes no reference anywhere to Harvey, nor does he seem, in his treatise on *Dropsy*, written in 1683, to have seen the bearing which Lower's experiments, made fourteen years previously, of ligature of the veins, had on dropsy. (æ) Sydenham considered "weakness of the blood" to be the sole cause of dropsy, and throughout his writings he nowhere alludes to the physiology of the tissues. He quotes Hippocrates with approval, as blaming those who in their exceeding curiosity and officiousness busied themselves in speculations on the human frame; and whilst admitting that more than one

valuable medicine had been obtained from the chemists, blames those who thought that medicine could be promoted by the new chemical inventions of his day ;¹ and he further on says, "The whole philosophy of medicine consists in working out the histories of diseases and applying the remedies which may dispel them ; and experience is the sole guide."² Yet Sydenham himself had his theories, and, viewed by the light of our present knowledge, very incorrect ones ; for without theory, or, in other words, general principles, experience is a blind and useless guide. Rational theories of disease and its treatment can only be founded on physiological knowledge ; and until, comparatively speaking, a very few years ago physiology and medicine were inseparably connected, for, with few exceptions, the former was cultivated by medical practitioners alone, and may, without disrespect, be said to have been parasitic on medicine.

This is no longer the case, for using the term in its widest sense, as embracing the study of life, whether under normal or ab-

¹ *On Dropsy*, par. 23, Syd. Soc. trans.

² *Op. cit.*, par. 45.

normal conditions, it has become the largest division of the natural sciences, throwing out like a gigantic tree huge branches from its main trunk, which depend more or less for support on chemistry and physics, and embracing within its ample boughs a vast series of subjects with whose rapid growth it is beyond the powers of any man to keep abreast. What is to be the future relation of it to medicine, or rather, I should say, of medicine to physiology? The old position is reversed, and medicine—that is, the study of the manifestations of disease, its origin, course, and the means of alleviating its effects or preventing its occurrence—may be regarded as a branch of physiology, and one not less scientific than the observation of physiological phenomena in the laboratory. The practitioner of medicine turns to the physiologist, the bacteriologist, the chemist, and the physicist for aid in unravelling and explaining the symptoms he observes and has to deal with, and so long as they work together in the spirit which influenced Harvey and Sydenham—the pursuit of truth—the world must be the gainer.

The very brilliancy of recent discoveries

and the vast increase in our knowledge may for a time react prejudicially on the art of medicine. Are we not in danger of being carried away by our enthusiasm? And may we not fall into the predicament described many years ago by Buckle, of our facts out-running our knowledge and encumbering our march? More especially does this difficulty arise in the training of our students. So vast is the range of subjects bearing on medicine, and so important does each appear to those best acquainted with them, that there seems to me danger lest, in endeavouring to secure an acquaintance with them all, we may forget that the future life of the majority of those entering our profession is to be spent in ministering to the victims of accident or disease, and that for the due recognition and treatment of sickness and injury, experience and trained clinical observation is absolutely necessary. No amount of laboratory training will enable a man to recognise the nature and proper mode of reduction of a dislocation, or know scabies when he sees it; and the words of Sydenham to his dear friend Dr. Mapletoft, “The art of medicine can be properly learned

only from experience and exercise," will always hold good.

There is no need to urge on the Fellows of the College another of Harvey's directions to the Orator of the day "to search out the secrets of nature by way of experiment," for at no period during the existence of our College have they manifested greater activity than at the present.

The great scientist who has recently passed away in the fulness of years and fame opened to us new and most fascinating fields for future research, pregnant, I believe, with an abundant harvest, of which he himself was permitted to see the firstfruits. Working out with scientific patience and accuracy the clue afforded by Jenner's discovery of the efficacy of vaccination in smallpox, Pasteur not only threw light on the darkness which surrounded the communicability of specific diseases, but placed in our hands the means to fight them. Pasteur has gone to his rest surrounded with all the honours a grateful nation could pay to his memory, and I know not that I can pay a greater tribute to his genius than by saying that he will worthily be placed in the Temple of Fame by the side

of our Harvey, both men honoured alike for the blameless character of their lives and the brilliancy of their discoveries. If we, as a nation, have not been able, through the action of our Legislature, to bear our full share in the furtherance of Pasteur's discoveries, we have at least the satisfaction that Lister was the first to recognise their bearing on morbid processes, and to introduce new principles into surgery, which have added a hundredfold to its powers. The later developments of Pasteur's discoveries in the hands of Koeb, Behring, Roux, Klein, and a host of equally earnest inquirers, have had in medicine a correspondingly important and beneficial effect on our conceptions of disease and its treatment.

Remarkable as has been the nineteenth century in the development of science and its application to the needs of mankind, in no direction has it been more remarkable than in the progress of medicine. The introduction of anæsthetics marks the middle of the century, and its close will in the future be ever memorable as the era in which we commenced to have a truer and fuller insight into the causation and nature of disease than the world has

yet seen. Let us all, then, strive to work after the examples of Sydenham and Harvey, in the confident hope that as our knowledge advances we shall obtain greater powers of control over disease in all its forms, and that pain and suffering may be yet further mitigated.

APPENDIX.

IN the Oration all the quotations from Harvey's works are taken from Willis's translation, published by the Sydenham Society in 1847; and those from Sydenham from the translation of his works by Dr. R. G. Latham for the same Society, published in 1850.

Note a, p. 7.

Records of Harvey, in 'Extracts from the Journals of the Royal Hospital of St. Bartholomew, with Notes by James Paget, Warden of the Collegiate Establishment and Lecturer on Physiology in the Hospital,' published by John Churchill, 1846. This work was republished in the *St. Bartholomew's Hospital Reports* for 1886.

Note b, p. 7.

Nothing is *known* of the early life of Dr. Richard Caldwell—Cauldwell—Calwale—and Chaldwell, for the name is spelt in these different ways. The year of his birth appears uncertain. Wood (*Athenæ Oxonienses*) says that he was thirty-two years old when he became a student of Christ Church in 1547, which would make him born in 1515. Dr. Munk, in his roll of the College, says about 1513, following the account given of him in *Chalmers's General Biographical Dictionary*. By the kindness of the Rev. T. Vere Bayne, Senior Student of Christ Church, and keeper of the Records in the University of Oxford, I am informed that Caldwell's (*sic*) name is fifth in the first list of students of Christ Church, 1547, and that in the Dean's Entrance Book the

following is appended to his name :—" Born in Staffordshire 1517, taken from Brasen Nose to this College A.D. 1554, where he continued his name till November, 1559. Went to London, where he practised physick with so good success that he became President of the College of Physitians, 1570. Died in London An^o. Dm. 1585" (vid. *Athen. Oxon.*, was physic Faculty Man).

The Dean's Entry Book is not of the date 154 $\frac{6}{7}$, but it may well have been copied from some earlier one at the commencement of the seventeenth century.

Holinshed, who says that he died in 1584, also states that he was by computation seventy-four years of age, which would make him born in 1510; so that we find four different years, 1510, 1513, 1515, and 1517, given as the year of his birth. The Dean's Entry Book is undoubtedly wrong in giving 1585 as the year of his death, and I should therefore distrust the accuracy of the entry relating to his birth. All authorities agree as to the times at which he took his various university degrees. He took his B.A. in 1533, his M.A. March 12th, 153 $\frac{8}{9}$, from Brasenose College, of which College he became a Fellow; he proceeded to the M.D. degree May 9th, 1554, being then on the list of senior students of Christ Church. Dr. Caldwell removed his name from the books of Christ Church in November, 1559, and very shortly—on December 22nd of the same year—was admitted a Fellow of our College, and appointed Censor the same day and President in 1570.

As Holinshed is not very easily accessible to many of our Fellows, I have thought it desirable to transcribe the following interesting account of Caldwell and the occasion of the delivery of the first Lumleian lecture *in extenso*.

HOLINSHED, III, 1369. QN. ELIZ., A.D. 1582.

"This yeare 1582 was there instituted and first founded a publike Lecture or lesson in Surgerie, to begin to be read in the College of Physicians in London, in Anno 1584, the first daie of

Maie, against that time new reedified in a part of the House that Doctor Linacre gave by Testament to them, by John Lumleie lord Lumleie, and Richard Caldwell doctor in Physicke, to the honour of God, the common profit of hir Maiesties subjects, with good fame, with increase of estimation and credit of all the surgians of this realme. The reader whereof to be a doctor of physicke, and of good practise and knowledge, and to have an honest stipend, no lesse than those of the universities erected by King Henrie the eight, namelie of law, divinitie and Physicke, and lands assured to the said College for the maintenance of the Publike lesson; whereunto such statutes be annexed as be for the great commoditie of those which shall give and incline themselves to be diligent hearers for the obtaining of knowledge in Surgerie, as whether he be learned or unlearned that shall become an auditor or hearer of the lecture, he may find himselfe not to repent the time so imployed. First twice a weeke thorough out the yeare; to wit, on Wednesdaies and Fridaies, at ten of the clocke till eleven, shall the reader read three quarters of an hour in Latine and the other quarter in English, wherein that shall be plainly declared for those that understand not Latine, what was said in Latine. And the first yeare to read *Horatius Morus* tables, an epitome or brief handling of all the whole art of surgerie, that is, of swellings or apostems, wounds, ulcers, bone-setting, and healing of bones broken, termed commonlie fractions, and to read Oribasins of knots, and Galen of bands, such workes as haue beene long hid, and are scarcelie now a daies among the learned knowen, and yet are (as the Anatomies) to the first enterers in Surgerie and novices in Physicke; but amongst the ancient writers and Grecians well knowne. At the end of the yeare in winter to dissect openlie in the reading place, all the bodie of man especiallie the inward parts for five daies together, as well before as after dinner; if the bodies may so last without annoie.

“The Second yeare to read *Tegaultius* institutions of Surgerie,

and onelie of swellings or apostems, and in the Winter to dissect the trunk onelie of the Bodie, namelie from the head to the lowest part where the members are, and to handle the muscles especiallie.

“The Third yeare to read of Wounds onelie of Tagaultius, and in Winter to make publike dissection of the head onelie.

“The Fourth yeare to read of ulcers onelie the same author, and to anatomize or dissect a leg and an arme for the knowledge of muscles, sinews, arteries, veins, gristles, ligaments and tendons.

“The Fift yeare to read the first book of Paulus Ægineta, and in Winter to make anatomie of a skeleton, and therewith all to shew and declare the use of certeine instruments; as *Scamnum Hippocratis*, and other instruments for setting in of bones.

“The sixt yeare to read *Holerius* of the matter of Surgerie, as of Medicines for Surgians to use.

“And the seventh yeare to begin againe, and continue still: A godlie and charitable erection doubtlesse, such as was the more needful, as hitherto hath beene the want and lacke so hurtfull: Sith that onelie in ech universities by the foundation of the ordinarie and publike lessons, then in one of Physicke, but none of Surgerie, and this onelie of Surgerie and not of Physicke, I mean so as Physicke is now taken separatelie from Surgerie, and that part which onelie useth the hand as it is sorted from the Apothecarie.

“So that now England may reioise for these happie benefactors & singular Well willers to their Countrie, who furnish hir so in all respects, that now she may as compare for the knowledge of physicke, so by means to come to it, with France, Italie, and Spaine, and in no case behind them but for a Lecture in simples, which God at his pleasure may procure, in mooving some hert after like motion and instinct to be as carefull and beneficiall as these were to the helpe and furtherance of their countrie.

“At the publication of this foundation, which was celebrated with a goodlie assemblie of Doctors, Collegiats, and Licentiats, as

also some Masters of Surgerie, with other Students, some whereof had been Academicall; Doctor Caldwell so aged that his number of yeeres with his white head adding double reverence to his person (whereof I may well saie no lesse than is left written of a doctor of the same faculties verie famous while he lived,

(Conspicienda ætas, sed et ars proveetior annis,
Famaque Pœonio non renuenda Choro).

Even he, notwithstanding his age and impotencie, made an oration in Latine to the auditorie, the same by occasion of his manifold debilities unfinished at the direetion speeiallie of the president, who (after a few words, shortlie and sweetlie uttered) gave occasion and opportunitie to Dr. Forster, then and yet the appointed Leeturer, to deliver his matter, which he discharged in such methodicall maner, that eeh one present indued with judgement, conceived such hope of the doctor, touching the performanee of all actions incident unto him by that place, as some of them continued his auditors in all weathers, and still hold out; whose diligence he requiteth with the imparting of further knowledge than the said publike lecture doth afford. When the assemblie was dissolved, and the founder accompanied home, diligent care was taken for the due preferring of this established exercise; in-
somuch that Dr. Caldwell, and Dr. Forsster, to furnish the auditors with such bookes as he was to read, caused to be printed the Epitome of *Horatius Morus* first in Latine; then in English, which was translated by the said doctor Caldwell. But before it was half perfected, the good old Doctor fell sicke, and as a candle goeth out of itselſe, or a ripe apple falling from the tree, so departed he out of this world, at the doctors commons, where his usual lodging was; and was very worshipfullie buried. But of his Death hereafter, in the year 1584: where the daie of his decease being mentioned, matter worth the reading shall be remembered."

HOLINSHED, III, 1369. QN. ELIZ., A.D. 1584.

“ In this yeare, and the Twentieth daie of Maie departed out of this life that famous father of Physicke and Surgerie, the English Hippocrates and Galen, I mean doctor Caldwell, and was buried on the sixt of June immediately following at St. Benets Church by Paules wharfe, at the upper end of the chancell: his bodie was verie solemnelie accompanied to the Church with a traine of learned and grave doctors, besides others of that facultie, the heralds of armes doing him such honour at his funerall as to him of dutie appertained. Of this mans rare loue to his Countrie hath beene spoken before, where mention is made [p. 1349] of the institution of a Surgerie Lecture perpetuallie to be continued for the common benefit of London, and consequentlie of all England: the like whereof is not established nor used in anie universitie of christendome (Bononie and Padua excepted) and therefore the more to be esteemed. Indeed the like Institution was in towardnesse, whiles Francis the French of that name the first liued: but when he died, as the Court that he kept in his time was counted a Universitie, but after his deth made an exchange thereof with another name: so likewise discontinued or rather utterlie brake off that purposed institution of a surgerie lecture at Paris; so that in this point London hath a prerogative excelling the Universities.

“ This Dr. Caldwell in his last will and Testament gave manie great legacies to a great number of his poorest kinsfolks, as also unto others nothing allied to him. He gave in his lifetime two hundred Pounds to be lent gratis for ever to the Clothiers in Burton, whereby clothing might be mainteined, the poore artificers set on worke, and the poore Citizens in Lichfield also benefited; the corporation of the said Towne being bound for the receiuing and delivering thereof euerie five yeares to the yoongest and poorest occupiers. He gave great summes of monie to the poore

townships in Staffordshire where he was borne, both towards relieving of their priuat Estate as also to the reparing of their Bridges and amending of their high waies, for the commoditie of all the countrie. He left large sums of monie to be employed by his executors at their discretion, where charitie moued; as also to the publishing of such learned bookes of physicke and surgerie (with sundrie chargeable formes graven in copper and finished in his life) as he meant (if he had lived) to see extant.

“Diverse good works in his daies he had doone, and hath left order to be doone after his death; which was verie mild and still, not unlike the decease of a babe in the cradle; hauing been assailed with no extremitie of sicknesse (his ordinarie infirmitie excepted which was intermissive) [NOTE His ordinarie infirmitie was the Colicke, which tormented him exceedingly] that either might wring him: or wearie him to make him impatient: So that he died as sleeping, having left behind him both credit of learning, cunning, and other good ornaments, the very beautie of his age, which was exactlie found by true computation to be threescore and foureteene in which yeare he died; as may be gathered by his counterfet so naturallie conueied into colours, with his white beard, the hollownesse of his cheekes, the wrinkels of his browes, the linelie sight of his eies, and other accessories; and all within a module, the circumference whereof exceedeth not six inches, if it amount to so much in exact measure, as a man beholding the said representation, would swere that it were not possible for art to draw more neere in imitation to nature. So that this Doctor being in so ripe an age, was committed to holie ground, where he rested in peace, his cote armour bearing witsesse of his ancestrie; for he beareth azure, a crosse forme fitch or, within an urle of stars, or; the second, argent, a fesse indented sable charged with foure leuses heads cirant rased or; the third as the second, and fourth as the first quarterlic. Also he beareth to his crest on a Tosse or and azure, a cocks head argent, couped, membred genles supporting a crosse forme fitch or, betweene two wings sable, and

mantled geules doubled argent. [The erosse forme fiehe was the cote of Cadwallader the last King of Britains, in A. Dom. 680.]

“In further Memorie of whome (so long as the Chureh wherein he lieth buried dooth stand, and the monuments therein blessed, from sacrilegious hands) there remaineth fixed in the wall over his grave, a copper plate wherein his said cote armour workemanlie grauen, with the armes of the Physieians College so under it as they are knit unto it. On either side of this latter seutchion are set certeine binding bands and other instruments of Surgerie in their right formes, with their proper use also to be practised upon ech member; be the same head, leg, arme, hand or foot; all workmanlie wrought, and under the same a memoriall graven for wished perpetuities :

Caldwallus jacet hic patriæ studiosus alumnus,
 Chirurgis Chiron, Hippocrates Medicis :
 Heracles laqueis dum fascia membra reuincit,
 Galenus priseæ laudis et artis amans :
 Chirurgis stabilem leeturam condidit, illi
 Præfecit Medicos, quos ea turba eolat :
 Plintheus hic astat laqueus, Carchesius, inde
 Fascia ; quæ studii sunt monumenta sui :
 Felix Chirurgus patronum qui tibi talem
 Nactus es, et felix qui dolet æger erit.

Laquei	{	Plintheus. 1.
	{	Charchesius. 2.
Fascia	{	Totum caput eingens. 3.
	{	Rhombus. 4.
Machinamenta	{	Seamnum Hippocrates. 5.
	{	Glossocodium. 6.

Quem tibi vinxisti charum dum vita manebat,
 Te eum Melpomene post tua fata canet.

RIC. FOSTERUS.

John Lord Lumley, who, with Dr. Caldwell, endowed the Surgical Leetureship, was the seventh Baron Lumley, and succeeded his grandfather, George Lumley. His own father, George Lumley, having been found guilty of high treason in the twenty-ninth year of Henry VIII, suffered death. He was created a Knight of the Bath two days before the coronation of Queen Mary, and was present with his wife at her coronation. He had married Jane, eldest daughter and co-heiress with her sister of the Earl of Arundel. Lord Lumley's connection with Oxford was owing to his being appointed high steward of the University, in succession to his father-in-law, as appears from the following letter from Lord Arundel, for a copy of which I am indebted to the Rev. T. Vere Bayne.

“ To my loving frends the Doctors the Proetors the Non regents and regents of the Universitie of Oxorde.

“ After my hartie comendacions. Whereas you have made me yo^r Chancellour being y^e Steward before, These are to give you hartie thanks for them bothe. certifieng you that I am content to aaccept it beinge so frely and frendly offered unto me. promising to be readie at all times to do not only for that universitie but for all and every one of you such pleasure as I can. And as concerning your Steward's office, albehit (as I understand) I may eyther kepe both or ells for the time I am your chancellour name and appoint my Steward there yet these are to desire you hartely in your next assemble to electe my son John the lord Lumley to the same. and to send it hym under your eomen seale as I have it.

(The rest is about other matters.)

“ fare ye well from Arundel house

the xxiii^jth of February 1558

“ Your loving frende

“ ARUNDELL.”

At the accession of Queen Elizabeth he was one of the Lords appointed to attend on her journey from Hatfield to London, and he was constituted one of the commissioners to settle the claims at her coronation. In the twelfth year of Elizabeth he, together with his father-in-law, was taken into custody, as privy to divers transactions relating to Mary, Queen of Scots, and to her designed marriage with the Duke of Norfolk. He managed to regain the confidence of Elizabeth, as in the 29th of Eliz. he was commissioned, with other Lords, for the trial of the Queen of Scots. He was one of the peers that sat on the trial of Robert Devereux, Earl of Essex. At the accession of James I he was constituted one of the Commissioners for settling the claims at his coronation.

He died on April 11th, 1609, and left no surviving issue, and was buried, in accordance with the directions in his will, under the chancel of the church at Cheam, where his first wife and her children had been previously buried. Lord Lumley was himself a fellow-commoner of Queen's College, Cambridge, and a patron of art and literature. He formed a collection of portraits and a library, and inherited the valuable collections of his father-in-law. Soon after his death his library was purchased by James I for his son, Prince Henry.

Note *c*, p. 9.

Dr. Richard Forster, the first holder of the Surgical Lectureship, was a Fellow of All Souls' College, Oxford, and an M.D. of that University. He is styled by Camden "nobilis mathematicus." Besides the office of Lecturer, he was Censor in 1583, Treasurer in 1600, and President of the College in 1601-3, and in 1615 and 1616, in which year he died on the 27th of March. Forster wrote the verses given in note *b* for the memorial to Caldwell.

Note *d*, p. 12.

The whole passage is worth quoting; it runs thus:—"He, together with his immediate successors, took the broadest view

of the subject. The structure of enttle-fishes and cray-fishes interested them as much as that of the higher animals. And insomuch as the taint of impurity which in ancient times attached to contact with the dead human subject hindered them from obtaining a knowledge of the structure of man directly, they were compelled to derive it by way of analogy from their observations on apes. In fact, this over-confidence in the extent to which the likeness extended led them into serious errors. At the revival of learning things took another turn ; Anatomy sank to the level of the mere handmaid of practical and theoretic Medicine. It was only very much later, as the anatomical like the other sciences progressed backwards to their original dignity and independence, that the position of Democritus and Aristotle was once more reached, and the study of the living body taken up for the sake of knowledge alone ; man assumed his place as neither more nor less scientifically interesting than his fellows.”—Appendix to *Sir R. Owen’s Life*.

Note e, p. 12.

This extract has been abbreviated ; in the original it stands, “and foremost of all among the ancients I follow Aristotle ; among the modern, Fabricius of Aquapendente : the former as my leader, the latter as my informant by the way.” Harvey also, in the introduction to *De Generatione Animalium*, calls Aristotle “the supreme Dictator in Philosophy,” which phrase he possibly took from Dante’s *Inferno*, canto iv, line 130, &c., which is thus translated by Haselfoot :

“ When I had raised my brows slight further space,
I saw the Master Sage of those who know
Sitting amid the philosophic race ;
All gaze on him, all honour to him show.”

Yet at the same time he warns his readers in another passage in the introduction to take nothing on authority, saying, “Take

nothing on trust from me concerning the generation of animals. I appeal to your own eyes as my witnesses and judge."

Note *f*, p. 17.

A friendly critic in the *British Medical Journal* has remarked that I seem in this paragraph to have fallen into some confusion ; it is true that I seem in this paragraph to blow both hot and cold on the doctrine of final causes. I did not intend to express any opinion on it, and I used the phrase "final causes" in the same way in which Aristotle himself does. He says (*On the Parts of Animals*, Book I, chap. i), "The causes concerned in the generation of the works of nature are, as we see, more than one. There is the final cause and the motor cause. Now we must decide which of these two causes comes first, which second. Plainly, however, that cause is the first which we call the final one. For this is the Reason, and the Reason forms the starting-point alike in works of art and works of nature." What I meant to convey was that Aristotle's reasons for the existence, arrangement, form, and function of many animals' structures were so erroneous that it led future ages to overlook much that was true and marvellously sagacious in his remarks on the structure of animals, and so his works fell into disrepute.

Bacon, in the second book of the *Novum Organon*, has analysed and reduced to rules the inductive process much in the same way that Aristotle had done for the syllogistic. A useful work, perhaps, but not one which has had any real influence on scientific discovery. Bacon's chief merit lies in his having aroused a spirit of inquiry into the physical forces of nature, and pointing out that philosophical researches into Nature in all her forms has more influence in advancing the well-being and happiness of mankind than all the subtleties of metaphysics, and that the ultimate end of knowledge is the employment of the gift of reason for the use and benefit of mankind.

Note *g*, p. 18.

Ramus, born 1515, wrote as a thesis for his M.A. degree an essay denying the authority of Aristotle. The first two books that he published were *Institutiones Dialecticæ* and *Aristotelicæ*, animadversions which so aroused the professors of Paris that they brought him before the magistrates as one in opposition to religion and learning. His books were prohibited from being sold, and Ramus was in 1543 forbidden to teach.

Owing to the influence of the Cardinal of Lorain with the king, Henry II, he became Regius Professor in the University of Paris in 1551, about which time he appears to have become a Protestant.

At the massacre of St. Bartholomew he was killed by assassins, who are said to have been hired by Charpentaire, a professor of mathematics in the university, for the purpose; after stabbing him in many places they threw his body out of the window, and a number of students of the Aristotelian faction dragged his mutilated body through the streets and threw it into the Seine.

Note *h*, p. 19.

The substance of the heart is described as strong muscle in the Hippocratic treatise, Περὶ Καρδίας. ἡ καρδία μῦς ἔστι κάρτα ἰσχυρός, οὐ τῶν νευρῶν ἀλλὰ πηλόμενι σαρκός, but I very much doubt if the author had any idea of the contractile power of the walls of the heart. That he was well acquainted with the appearance of the inner surface of the heart is, I think, shown by the use of the word πηλόμενα, which is used by Galen for felted wool and things made of it, the columnæ carneæ giving a felted appearance to the inner surface of the heart. Nowhere in the treatise is any passage met with intimating that the action of the heart was the cause of movement in the blood.

Note *h*, p. 20.

Vide on these points the introduction to the disquisition on the *Motion of the Heart and Blood*, p. 13, last two lines,

chap. iii, pp. 25 and 26. The *Second Disquisition to Riolanus*, pp. 112 and 113, 135.

Note *k*, p. 23.

Exercises lxvii and lxviii, pp. 477, 478, 479. These repeated examinations of the uterus of the hind and doe were made on animals given to Harvey for the purpose by the king.

Note *l*, p. 23.

Harvey gives us the arguments, or at least some of them, in the *Essay on Conception*, where this view is broached at length; and the creations, as he terms them, of the uterus are compared with creations of the brain (*vide* p. 577). His arguments are not very strong, but the whole essay on conception is conceived in a Platonic rather than an Aristotelian spirit.

Note *m*, p. 23.

The words of Harvey which approach nearest to this aphorism are “nos autem asserimus (ut ex dicendis constabit) omnia omnino animalia, etiam vivipara, atque hominem etiam ipsum, ex ovo progigni” (Exercise I). *Vide* on this point Dr. Arthur Farre’s *Harveian Oration* in 1872. Dr. Farre is, I think, the only Harveian orator who has treated at length with the *De Generatione Animalium*.

Note *n*, p. 25.

Exercise xli. And he goes on to remark, “And yet these animals are supposed to have arisen spontaneously or from decomposition, because their ova are nowhere to be found. This exercise concludes with a remarkable passage concerning epidemic and contagious diseases, in which Harvey distinctly foreshadows the doctrine that epidemic, contagious, and pestilential diseases are propagated through the air by bodies multiplying themselves by a kind of generation.”

Note o, p. 25.

Exercise iii. In the course of this exercise Harvey writes, "We may be permitted to ask whether in man, whilst he lives, there is not a passage from openings of the same kind into the cavity of the thorax? For how else should the pus poured out in empyema and the blood extravasated in plenrisy make its escape? In penetrating wounds of the chest, the lungs themselves being uninjured, air often escapes by the wound; or liquids thrown into the cavity of the thorax are discharged with the expectoration. But our views on this subject will be found fully expressed elsewhere, viz. in our disquisitions on the 'Causes, Uses, and Organs of Respiration.'" It is instructive to see here that Harvey's acquaintance with comparative anatomy led him astray. One would like to know what were the cases which he treated of in his disquisition on the 'Causes, Uses, and Organs of Respiration' which caused him to come to the above erroneous conclusions.

John Hunter's demonstrations of these receptacles of air in birds are to be found in vol. lxiv (1774) of the *Philosophical Transactions*, p. 205.

Note p, p. 26.

Exercise lvii. He goes on to say, "And this, too, is a remarkable fact, that virtues and vices, marks and moles, and even particular dispositions to disease, are transmitted by parents to their offspring; and that while some inherit in this way, all do not."

Note q, p. 28.

Exercise lxxi. The whole of this exercise is most interesting; in it we see Harvey was evidently in perplexity. His own clear judgment urged him to the conclusion that the blood and innate heat were inseparable. He could not rest contented with the older view that "spirits" existed apart from the blood, and that the office of the arteries and heart was to contain them. Harvey quotes Fernelius (*Physiologia*, lib. iv, cap. 2): "He who has not yet mastered the matter and the state of the ingenerate heat, let him cast an eye upon the structure of the body, and turn to the

arteries, and contemplate the sinuses of the heart and the ventricles of the brain. When he observes them empty, containing next to no fluid, and yet feels that he must own such parts not made in vain or without design, he will soon, I conceive, be brought to conclude that an extremely subtile aura or vapour fills them during the life of the animal, and which, as being of extreme lightness, vanished insensibly when the creature died. It is for the sake of cherishing this aura that by inspiration we take in air, which not only serves for the refrigeration of the body, by a business that might be otherwise accomplished, but further supplies a kind of nourishment."

To this Harvey replies, "But we maintain that so long as an animal lives the cavity of the heart and arteries is filled with blood;" and in the opening paragraph of the exercise he writes, "There is, in fact, no occasion for searching after spirits foreign to or distinct from the blood; to evoke heat from another source; to bring gods upon the scene, and to encumber philosophy with any fanciful conceits: what we are wont to derive from the start is in truth produced at home; the blood is the only *calidum innatum* or first engendered animal heat." Yet was present to Harvey's mind—what makes the blood hot? Aristotle recognised that "the heat contained in animals' bodies is not fire, nor does it derive its origin from fire." So Harvey, throwing over all lower views, says that blood obtains its heat from a divine source, and that "it comes to the same thing whether we say that the soul and the blood, or the blood with the soul, or the soul with the blood, performs all the acts in the animal organism." Harvey in this exercise appears to me to apply a different meaning to the word *anima* from that in which he uses it in the twenty-sixth and twenty-seventh exercises, where *anima* stands for something still more divine and inscrutable than animal heat—"in the vital principle." Of innate heat we now have great although not perfect knowledge, as to how it is maintained; of the vital principle we are in the same position as Harvey himself.

Note r, p. 31.

Vide Prelectiones, folio 84.

Note s, p. 31.

Mayow was a pupil and Lower a coadjutor with Willis, whose fame rests on his anatomical rather than his physiological work. In physiology and physiological chemistry Willis allowed himself to indulge in most extravagant hypotheses, and his works have consequently fallen into oblivion, though much that he wrote on the practice of medicine was excellent and greatly in advance of his times.

Willis wrote much concerning the soul, by which he meant the vital force, and considered the soul of brutes to be corporeal and fiery, and says, "The soul lying hid in the blood or vital liquor is a certain flame or fire;" and quotes Gassendus with approval: "The soul, therefore, is a certain flame, or a species of most thin fire, which as long as it lives or remains inkindled, so long the animal lives; when it no longer lives, or is extinguished, the animal dyes."

Willis separates the rational soul which is in man, from the corporeal which man shares with brutes.

John Mayow was born in London in the parish of St. Dunstan's-in-the-West, 1643, but belonged to a Cornish family, and is described at his matriculation at Wadham College, Oxford, as living at Bree. He entered at Wadham July 2nd, 1658, became a scholar of his college the succeeding year, and a Fellow of All Souls in 1660. He does not appear to have taken any medical degree at Oxford, but became Bachelor of Civil Law 1665, and Doctor 1670. I have been unable to find out if he had any medical degree; he was not a Fellow of our College, but was elected a Fellow of the Royal Society in 1678, the year before he died. His death occurred at the house of an apothecary, of the sign of the Anker, in York Street, Covent Garden, and he is buried in the parish church of St. Paul. The circumstances connected with his death are not known, and singularly little seems to be known of his life. His *Traetatus*

Quinque, published in 1674, are remarkable for the originality and correctness of the views expressed in them.

His idea of a universal salt, which was of the nature of nitre, was not original; he followed out more scientifically and exactly the teaching of his old master, Willis.

Richard Lower was born at Tremere, near Bodmin. He was educated at Westminster School, whence he proceeded as a student to Christ Church. He assisted Willis in his dissections of the brain and nerves, and in 1669 published his *Tractatus de Corde, item de Motu et Colore Sanguinis et Chyli in eum transitu*. He speaks thus of Harvey and his work in the epistle dedicatory:—"Harvey so described as much as belonged to that most noble discovery of the circulation of the blood, that he left nothing to be added or described by his successors. For as in the Ptolemaic hypothesis of the heavens, besides the immense revolutions of the universe, lesser epicycles also are assigned to the planets, themselves necessary for the explanation of the phenomena; so in the system of the human body, as well as in that of animals, besides the Harveian circulation there are also other things to be considered."

Lower's work attracted general notice from his description of transfusion of blood; he was elected a Fellow of the Royal Society in 1667.

For a full account of the history of transfusion of blood I would refer those interested in the question to Note 20 in Dr. Ogle's appendix to his *Harveian Oration*, 1881, which not only on this point but on many others is a perfect mine of information on subjects connected with medicine.

Lower was not only a physiologist, but a pathologist and an excellent practical physician; he gives an account of the true nature of the so-called worms, snakes, and polypi of the heart, though he mistook post-mortem clots for ante-mortem changes. He gives an excellent account of the cause of fainting, and recommends placing the patient in the recumbent posture.

Note *t*, p. 33.

Dr. Adams, in his preliminary discourse on the *Hippocratic Treatises*, vol. i, sect. ii, p. 110, prefixed to the Sydenham Society's translation of Hippocrates, says of the author of the treatise *Περὶ φύσιος παιδίου* that he "holds that the fœtus breathes and is nourished by the umbilicus, which may be looked upon as an anticipation of the modern doctrine that the placenta performs the function both of a lung and an intestine." On turning to the passage in the treatise I cannot see that this contention is borne out. The Greek is as follows:—

"Εν τῇσι μήτρῃσιν ἡ γονὴ ἐνεῶσα ἔλκει ἀπὸ τοῦ σώματος ἄει, ὥπως ἂν καὶ δυνάμιος ἔχῃ. Ταύτῃ καὶ ἡ πνοή. Καὶ τὸ μὲν πρῶτον σμικρὴ ἡ πνοὴ γίνεται. Καὶ τὸ αἷμα ὀλίγον χωρεῖ ἀπὸ τῆς μητρός, ὁκόταν δε ἡ πνοὴ ἐπὶ πλεῖον γίνεται μᾶλλον ἔλκει τὸ αἷμα καὶ ἐπὶ πλεῖον κατέρκεται ἐπὶ τὰς μήτρας."

This passage, taken in connection with one which precedes it—"Ὅτι δὲ ἡ γονὴ ἐν ὑμένι ἐστὶ καὶ πνοὴν ἔχει καὶ εἶσω καὶ ἔξω καὶ αὔξεται ὑπὸ τῆς μητρός τοῦ αἵματος κατιόντας ἐπὶ τὰς μήτρας,"—seems to me to amount to nothing more than a bald and erroneous statement that the fœtus when within the membranes breathes. The Hippocratic treatise, *Περὶ φύσιος παιδίου*, is by all critics considered not to be a genuine work of Hippocrates, although it dates from a very early period.

Note *u*, p. 33.

We are very apt to forget how recent our knowledge of the chemical changes which take place in respiration is. John Hunter held nearly the same views of the vital spirit as Harvey, for he says, "I should consider life as a fire, or something similar, which might for distinction be called animal fire;" and his opinion of how this fire is maintained is entirely erroneous, for he says, "Instead of something vivifying being taken from the air, the air carries off that principle which encloses and retains this animal

fire ; the aliment we take in has in it in a fixed state the real life, and this does not become active until it has got into the lungs, for there it is freed from its prison.”¹

Note v, p. 35.

An amusing instance of the sort of attacks which were made on Harvey is to be met with in a pamphlet dedicated to Sir Thos. Mayerne, to be found in *Somer's Tracts*, second collection, vol. ii, p. 423. The pamphlet is entitled “A most certaine and true Relation of a strange Monster or Serpent found in the left Ventricle of the Heart of John Pennant, Gentleman of the Age of 21 years. By Edward May, Doctor of Philosophy and Physick, and Professor elect of them in the College of the Academy of Noblemen called the Muscum Minervæ. Physician also extraordinary unto her most sacred Majesty Queen of Great Britain, &c.,” 1639. The attack on Harvey is in a foot-note, and runs as follows:—“Here those men may be handsomely questioned who say that the pulse is nothing else but the impulse of the blood into the arteryes or the systole of the heart ; what was become of the pulse in this man all the while, that the whole blood betooke itself into the heart ? here was either a living man without pulse or pulse without the systole of the heart. For what could the arteries receive when nothing was to be received ? Or how could there be pulse when there was no impulse into the arteryes ? The pulse then doubtless is from another cause, and is a farre other matter than most men conceive : for there are in a sound man 4450 pulsations in an houre, in a sick man, some percute fevers and diseases, above 35,600 and more, which cannot be from so many several expressions or receptions of the blood ; for it is impossible the heart should make compression and the arteryes apertion so often in that space. Nay, in Dierot, Caprizant, and other inordinate pulses, diverse pulses strike in lesse space than the open mouth of an artery can open, shut, and open again, which

¹ *Essays and Observations*, edited by R. Owen, vol. i, p. 113.

3 acts are requisite to the beginning of a second pulse. But of this I have largely treated in my 3 Books de febris.

Note *w*, p. 36.

On this point Dr. Latham remarks, "I am not able to fix the year when Sydenham established himself in London, or, more properly speaking, Westminster. It was certainly before the year 1661, probably several years before." My colleague, Dr. Gee, was, I think, the first person to point¹ out that there exists in Sydenham's own works a passage by which the date of his setting up practice in Westminster can be approximately fixed. In the *Tractatus de Hydropo*, section 13,² he says, "Equidem probe memini (cum tunc primum ad Hydropem curandum invitarer) me annis abhinc viginti septem aut circiter, ad matronam quandam piam et honestam, nomine Saltmarsh, Westmonasterii commorantem, fuisse accersitum; ejus abdomen Hydrops, quo atrociorē nondum vidi, in molem magnitudinis vix credendæ evexerat."

The *Tractatus* was written in 1683; subtracting twenty-seven from it leaves 1656 as the time when Sydenham attended this worthy matron, whom he cured of her ascites by daily doses of syrup of buckthorn, and the passage thus confirms Dr. Latham's opinion that Sydenham was resident some years before 1661.

Note *x*, p. 40.

Sydenham appears to have either not appreciated or not to have known the latest advances in physiological knowledge and research. He writes thus in section 22 of the *Treatise on Dropsy*:—"By diligent research during dissections and by careful scrutiny we may attain to the knowledge of these larger organs by which Nature conducts her more visible operations. What, however, neither human eye will see, nor microscope disclose, is the origin

¹ *St. Bartholomew's Hospital Reports*, vol. xix, p. 1.

² Page 459 of Greenhill's edition of his works for the Sydenham Society.

and primary cause of such movements. What microscope, however exquisitely elaborate, shall make visible those minute pores by which, for example, the chyle passes from the intestines to the chyliferous vessels? Or what microscope shall exhibit those ducts through which the blood, conducted by the arteries, is passed onward to the orifices of the veins? These, and others innumerable, others more beautifully wrought, are but a small portion of the pores and passages of the wondrous fabric of the human body, a fabric which the wisest has not even seen in a dream. All our knowledge—I speak respectfully—all our knowledge is gross and rough, dealing only with the outer husk of the things that we would know, ascertaining only, at its highest level, *how* things are, but by no means grasping *why* they are so.”

From this passage it seems that he either did not know of Malpighi’s demonstrations of the circulation in the lung and bladder of the frog in 1661, or those of Mr. Wm. Molyneux made before the Royal Society of the circulation in the newt, and published in the *Philosophical Transactions* for 1683, vol. xv, p. 1236, the same year in which Sydenham published his *Tractatus de Hydropo*, or that he did not attach the importance to them which they deserved.

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